

Notice of Allowability

Application No.

10/791,257

Examiner

Kevin M. Bernaltz

Applicant(s)

ARNOLD ET AL.

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1773

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to interview of 5/25/06.
2. ☒ The allowed claim(s) is/are 1-13 and 18-21.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date 5/25/06.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____

Drawings

1. The drawings were received on March 20, 2006. These drawings are accepted.

Examiner's Amendment

2. Claims 1 and 11 are directed to an allowable product and method, respectively. Pursuant to the procedures set forth in MPEP § 821.04(B), claims 19 and 20, directed to the process of making or using an allowable product, previously withdrawn from consideration as a result of a restriction requirement, are hereby rejoined and fully examined for patentability under 37 CFR 1.104.

Because all claims previously withdrawn from consideration under 37 CFR 1.142 have been rejoined, the restriction requirement as set forth in the Office action mailed on July 5, 2005 is hereby withdrawn. In view of the withdrawal of the restriction requirement as to the rejoined inventions, applicant(s) are advised that if any claims including all the limitations of an allowable product claim or rejoined process claim are presented in a continuation or divisional application, such claims may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application. Once the restriction requirement is withdrawn, the provisions of 35 U.S.C. 121 are no longer applicable. See *In re Ziegler*, 443 F.2d 1211, 1215, 170 USPQ 129, 131-32 (CCPA 1971). See also MPEP § 804.01.

3. An Examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided

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by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

4. Authorization for this examiner's amendment was given in a telephone interview with Ms. Melissa Haapala on May 25, 2006.

The application has been amended as follows:

- Claims 1, 3 and 11 have been amended as follows:

Claim 1 (Currently Amended). A magnetoresistive sensor, comprising: a plurality of sensor stack layers, wherein [a layer in] the plurality of sensor stack layers [is] includes at least a pinned magnetic layer and a free layer; and at least one stabilizer depression formed in one sensor stack layer within the plurality of sensor stack layers, wherein the at least one stabilizer depression is located at least in the free magnetic layer and imparts a restorative force on a magnetic field of the free layer of the magnetoresistive sensor to align the magnetic field with a bias direction, wherein the magnetic field of the free layer aligned with the bias direction is longitudinally oriented parallel to the plane of the magnetoresistive sensor and each of the at least one stabilizer depressions consists of two edges elevated above a depressed center portion, wherein the edges run parallel to the direction of magnetization of said free layer and perpendicular to the surface of a magnetic media when the magnetic media is read by the magnetoresistive sensor.

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Claim 3 (Currently Amended). A magnetoresistive sensor, comprising: a plurality of sensor stack layers, wherein [a layer in] the plurality of sensor stack layers [is] includes at least a pinned magnetic layer and a free layer; and at least one stabilizer depression formed in one sensor stack layer within the plurality of sensor stack layers, wherein the at least one stabilizer depression is located at least in the free magnetic layer and imparts a restorative force on a magnetic field of the free layer of the magnetoresistive sensor to align the magnetic field with a bias direction; wherein the magnetoresistive sensor is a bottom spin valve sensor, wherein the magnetic field of the free layer aligned with the bias direction is longitudinally oriented parallel to the plane of the magnetoresistive sensor and each of the at least one stabilizer depressions consists of two edges elevated above a depressed center portion, wherein the edges run parallel to the direction of magnetization of said free layer and perpendicular to the surface of a magnetic media when the magnetic media is read by the magnetoresistive sensor.

Claim 11 (Currently Amended). A method of providing a magnetoresistive sensor, comprising: providing at least one stabilizer depression formed in one sensor stack layer within a plurality of sensor stack layers, wherein [a layer in] the plurality of sensor stack layers [is] includes at least a pinned magnetic layer and a free layer[,] wherein the at least one stabilizer depression is located at least in the free magnetic layer and imparts a restorative force on a magnetic field of the free layer of the magnetoresistive sensor to align the magnetic field with a bias direction, wherein the magnetic field of the free layer aligned with the bias direction is longitudinally oriented parallel to the plane of

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the magnetoresistive sensor and each of the at least one stabilizer depressions consists of two edges elevated above a depressed center portion, wherein the edges run parallel to the direction of magnetization of said free layer and perpendicular to the surface of a magnetic media when the magnetic media is read by the magnetoresistive sensor.

- Claims 19 and 20 have been rejoined, as noted above; and
- Claims 22 – 24 have been cancelled.

Reasons for Allowance

5. The present claims are deemed allowable over the references of record since the references of record fail to disclose or render obvious a MR element meeting the claimed structural limitations wherein the stabilizing depression imparts a restorative force on a magnetic field of the free layer to align the magnetic field with a bias direction as claimed.

While the prior art of record disclose MR elements comprising depressions/grooves in various locations of the MR element, the prior art of record fail to explicitly teach placing a stabilizing depression meeting applicants' claimed structural limitations in a MR element comprising at least a free and pinned magnetic layer, wherein the stabilizing depression either is explicitly is taught to, or there is sound basis that it would inherently, stabilize the free magnetic layer as claimed.

6. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

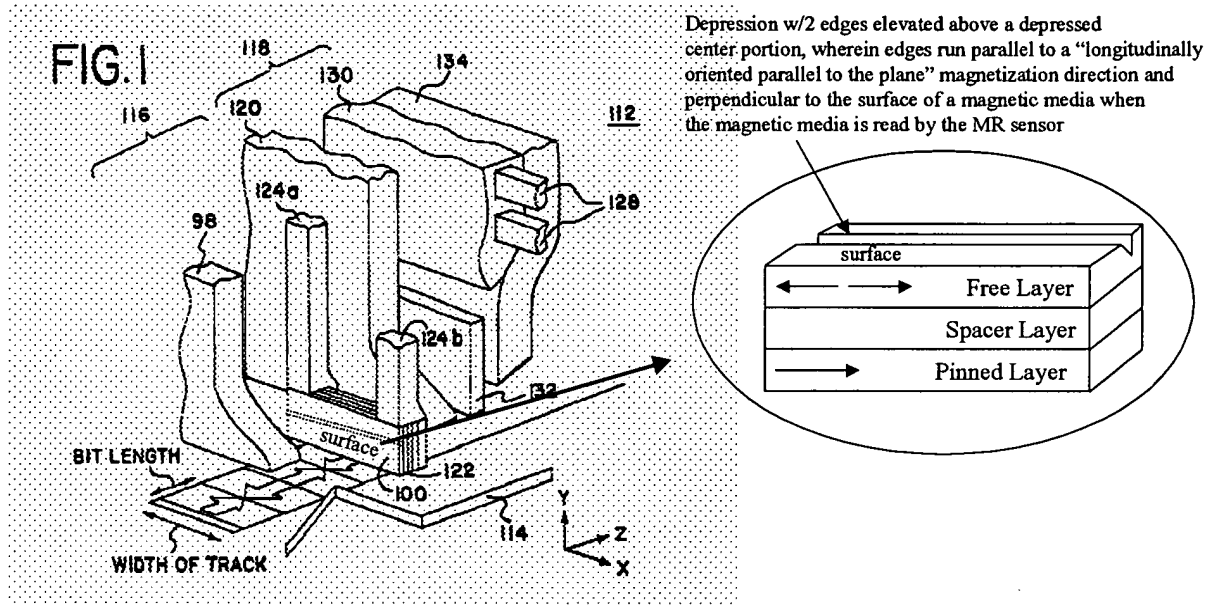
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accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Examiner's Comments

7. In order to better clarify the record, the examiner wishes to point out the following prior art references cited as being pertinent to the record. Nagasawa et al. (U.S. Patent No. 6,327,121 B1) illustrates what the Examiner deems would be within the knowledge of one of ordinary skill in the art in terms of the general structure of a MR sensor and magnetic recording medium (see *Figure 1 of Nagasawa et al. and Figure 1 below*). The Examiner notes that the schematic MR sensor reproduced below is purely for illustration purposes of how the Examiner has interpreted the claim language in terms of the orientation of the stabilizing depression and is not meant to convey any additional structural limitations as being "read into" the claims.

Figure I – Illustration of how the Examiner has interpreted the present claim language



Ohsawa et al. (U.S. Patent No. 6,118,621) teach a MR sensor wherein two protrusions are placed adjacent the MR sensor, but the Examiner notes that these protrusions are placed to set the track width (T_R), and would hence result in a depression running parallel to the surface of a magnetic media and perpendicular to a longitudinally oriented parallel to the plane magnetization direction.

Itoh et al. (U.S. Patent No. 6,707,648 B2) teach imparting grooves to an electrode above a free magnetic layer, but the Examiner notes that since the reference teaches that the grooves are above the free magnetic layer there would not be sound

basis that the grooves would impart any restorative force to the free magnetic layer. Furthermore, it appears from the Figures that the grooves are in a similar directional orientation as the grooves in Ohsawa et al. (i.e. opposite to what is presently claimed).

Mao et al. (U.S. Patent No. 6,411,478 B1) disclose filled "grooves" (elements 360 and 365) designed to separate the pinned and free magnetic layers. Without commenting on whether these grooves would inherently meet the claimed functional limitation, the Examiner notes that these grooves are again oriented opposite to what is claimed, i.e. parallel to the surface of a magnetic recording medium and perpendicular to a longitudinally oriented parallel to the plane magnetization direction.

Maeda et al. (U.S. Patent No. 5,680,091) teach steps in both directions (see *Figures 13 – 16*), but there is no teaching or suggestion that the claimed sensor would meet the limitations of imparting a restorative force on the free magnetic layer so as to align the magnetic field with a bias direction, wherein the magnetic field and bias direction are longitudinally oriented parallel to the plane of the magnetoresistive sensor. The Examiner further notes that the depressions which might result from the pattern of *Figures 13 – 16* are not deemed to be taught with sufficient specificity to render obvious a stabilizing depression meeting all of the structural requirements of the present claims (specifically, the Examiner deems that impermissible hindsight must be employed to modify the disclosure of Maeda et al. to read on the pending claims, since the prior art of record does not provide the proper motivation to anticipate or render the pending claims obvious).

Nomura et al. (U.S. Patent No. 4,477,794) teach a single magnetic layer MR element wherein stabilizing grooves are formed on the magnetic body in a direction meeting the claimed limitation in order to stabilize the layer against Barkhausen noise and domain wall movement (*Abstract and Figures, especially Figure 23*). However, Nomura et al. only teaches this structure for single magnetic layer MR elements and provides no guidance or suggestion that such a structure could be utilized for a MR element comprising at least a free magnetic layer and a pinned magnetic layer. The Examiner notes that the behavior of a single magnetic layer MR element and a MR element comprising at least a free magnetic layer and a pinned magnetic layer is significantly different that one of ordinary skill in the art would not have been motivated to combine the teachings absent an explicit teaching that such a combination would possess any reasonable chance of success. Prior to the present application, the prior art is silent about the possibility of modifying a MR sensor possessing at least a free magnetic layer and a pinned magnetic layer in a manner meeting the present claimed limitations.

Conclusion

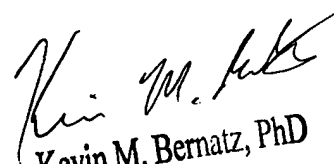
8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M. Bernatz whose telephone number is (571) 272-1505. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carol Chaney can be reached on (571) 272-1284. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KMB
May 25, 2006


Kevin M. Bernatz, PhD
Primary Examiner